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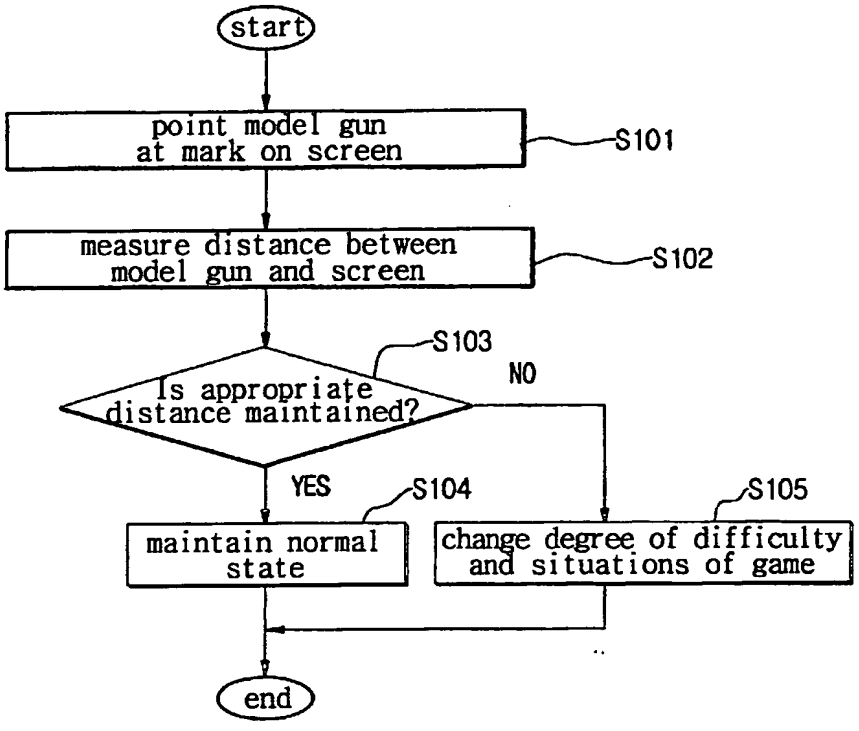

(57) Abstract: The present invention discloses an infrared detection type shooting game machine and method, which changes the degree of difficulty and environment of a game depending upon a distance measured using a plurality of references arranged at irregular intervals, thus providing realistic and interesting games. The shooting game method includes (a) displaying images, including a mark, by a display means and displaying a plurality of references that are bases for detection of coordinates; (b) detecting a partial image of a certain region of a point indicated through an indication means manipulated by a player; (c) receiving the detected partial image, detecting coordinates of the references, and setting coordinates of the references to the detected coordinates of the references; (d) detecting indicated coordinates of the point indicated by the player based upon the coordinates of the references; (e) measuring a distance D between the display means and the indication means based upon previously stored intervals between the plurality stored intervals between the plurality of references and distances between the coordinates of the references; and (f) setting reference distances D_0 to some of distances D between the display means and the indication means falling within a certain range, and changing a degree of difficulty and situations of the game depending upon whether the reference distances are fulfilled.

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SHOOTING GAME MACHINE AND METHOD FOR PERFORMING IT

Technical Field

The present invention relates generally to a shooting game machine, and more particularly to an infrared detection type shooting game machine and method, which changes the degree of difficulty and environment of a game depending upon a distance measured using a plurality of references arranged at irregular intervals, thus providing realistic and interesting games.

Background Art

The present invention is the improvement of Korean Pat. Appl. No. 10-2002-43913 filed on July 25, 2002 and entitled adjustment of the degree of difficulty and situations in a game. The contents of this patent application, closely related to the present invention, are incorporated herein.

Referring to FIG. 1 illustrating the perspective view of a prior art shooting game machine, the prior art shooting game machine includes a game machine box 1, a screen 1a, an image generator 2 positioned in the game machine box 1, a translucent reflecting mirror 3 for displaying an image generated from the image generator 2 on the screen 1a, an infrared ray generating device 4 for generating references 7 that are the bases for the calculation of coordinates, a control means 5 for controlling the entire shooting game machine, and a coordinate detecting means 6 for detecting coordinates indicated by a player based on the references by the infrared ray generating device 4.

Further, the shooting game machine further includes a model gun 10 for pointing at a mark on the image displayed on the screen 1a. The model gun 10 includes a barrel 10a, a trigger 11, a vibration-proof member 12 such as rubber, a Charge Coupled Device (CCD) camera 13, a lens 14 and an infrared ray pass filter 15. An image detected through the CCD camera 13 is transmitted to the

coordinate detecting means 6 via a communications line 16 connected to the model gun 10. A CCD of the CCD camera 13 is generally rectangularly shaped, and the CCD is used with the side thereof having a greater number of pixels arranged along a horizontal direction.

A display means for displaying the image of a game in the shooting game machine constructed as described above includes the screen 1a, the image generator 2 and the translucent reflecting mirror 3. The image information of the game, including a mark, transmitted from the control means 5 is converted into the light of a visible light range by the image generator 2, reflected by the translucent mirror 3, and finally irradiated to the screen 1a, thus being observed by the player. In this case, light emitted from the infrared light generator 4 is reflected by the translucent reflecting mirror 3 and irradiated to the screen 1a, thereby indicating the references 7 that are the bases for the detection of coordinates.

The player points to the screen 1a with the model gun in this hand. In this case, the image and the references 7 displayed on the screen 1a reach the infrared ray pass filter. At this time, the light of a visible ray range cannot pass through the infrared ray pass filter 15, while the references 7, that is, the light of an infrared ray range, passes through the infrared ray pass filter 15.

The references 7 having passed through the infrared ray pass filter 15 form images on the CCD camera 13 through the lens 14, the references 7 having formed images on the CCD camera 13 are converted into an image composed of electric signals, and the image of electric signals are transmitted to the coordinate detecting means 6. At this time, when the player pulls the trigger 11, the coordinate detecting means calculates the coordinates of the references and obtains indicated coordinates, that is, indicated coordinates on the screen 1a indicated by the player, based on the coordinates of the references.

The indicated coordinates obtained as described above are transmitted to the control means 5, and the control means 5 determines whether a mark is hit by comparing the coordinates at the moment the player pulled the trigger 11 with the

indicated coordinates.

However, the prior art shooting game machine has disadvantages in that it is impossible to accurately calculate a position, since one, two or more references generated by the infrared ray generating device 4 are distributed around the image without a specified rule and the indicated coordinates of the player are detected on the condition that it is assumed that the model gun 10 is not rotated.

That is, as shown in FIG. 4a, in the prior art shooting game machine, two references {the coordinates of the references on the CCD camera 13 are $p_1 = (p_{1X}, p_{1Y})$, $p_2 = (p_{2X}, p_{2Y})$ (it is assumed that the origin of the coordinates of the CCD camera is the upper left corner) and the coordinates of the center of the screen 1a on the screen 1a are previously stored (X_0, Y_o)} generally arranged to be symmetrical to the center of the screen 1a, and the indicated coordinates are detected only when all the references are detected by the CCD camera 13.

The coordinate detecting means 6 calculates the coordinates $\{ p_0 = (p_{0X}, p_{0Y}) \}$ of the centers (the centers of the references become the center of the screen 1a because the references are arranged to be symmetrical to the center of the screen 1a) of the references on the CCD camera 13 by the method of calculating the coordinates $\{ p_1 = (p_{1X}, p_{1Y}), \quad p_2 = (p_{2X}, p_{2Y}) \}$ of the references on the CCD camera 13 and obtaining the center of gravity. Since the distance D between the references on the CCD camera 13 is obtained by $d = \sqrt{(p_{2X} - p_{1X})^2 + (p_{2Y} - p_{1Y})^2}$, the indicated coordinates are obtained by $X = X_0 + (C_X - p_{0X})\frac{L}{d}$ and $Y = Y_0 + (C_Y - p_{0Y})\frac{L}{d}$ when the coordinates of the center of the CCD camera 13 on the CCD camera 13 are $C = (C_X, C_Y)$ and the distance between the references on the screen 1a is L.

Accordingly, the prior art shooting game machine cannot obtain the

accurate indicated coordinates when the player is positioned very close to the screen 1a or far from the screen 1a (all the references are not detected by the CCD camera 13), and the prior art shooting game machine cannot obtain the accurate indicated coordinates when the rotation of the model gun 10 is taken into consideration as in the present invention because the prior art shooting game machine employs a method of calculating the indicated coordinates without taking the rotation of the model gun 10 into consideration.

Further, since the prior art shooting game machine uses all the displayed references to detect the indicated coordinates 8 indicated by the player and detects the indicated coordinates 8 in the above described manner, the prior art shooting game machine is disadvantageous in that the indicated coordinates 8 cannot be detected if part of the references are not detected due to the partial failure of the infrared ray generating device 4.

Further, since the prior art shooting game machine can detect the indicated coordinates only when the prior art shooting game machine detects all the used references, the prior art shooting game machine is disadvantageous in that a range, which can be detected by the CCD camera of the same size, is very small.

Further, in the prior art shooting game machine, the game is played only in such a way that the player passively acts in response to the contents of the game provided by the control means 5. Additionally, the prior art shooting game machine is disadvantageous in that the prior art shooting game machine cannot provide a realistic game because the prior art shooting game machine cannot reflect the detected rotation of the model gun 10 and a detected variation in the distance between the model gun 10 and the screen 1a.

The distance between the model gun 10 and the screen 1a may be changed depending upon the player. The player in a good physical condition may reduce the distance and play the game at a position close to the screen 1a. Since the position close to the screen 1a can improve shooting accuracy, equal games cannot be played. All players would desire to play games at positions

close to the screen 1a.

Further, since the CCD camera 13 used in the prior shooting game machine is not fixed and can be freely moved by the player, an image can be detected with the same CCD. The prior shooting game machine does not utilize resolution by detecting the indicated coordinates based upon the above-described limited distribution of the references.

The index used to detect images in a shooting game machine is the resolution, and the resolution of the CCD of the CCD camera directly affects the image detection resolution. The method of increasing the resolution of the CCD is the easiest method to increase the image detection resolution. The method of increasing the resolution of the CCD has limitations in cost and technology because the costs of the CCD are increased and the amounts of data to transmit and process are increased and a high-speed transmission method and a high-performance processing apparatus are required.

Disclosure of the Invention

Accordingly, the present invention has been made keeping in mind the above problems occurring in the prior art, and an object of the present invention is to provide a shooting game machine and method that can improve an interest in an game by changing a game environment depending upon the distance between a model gun and a screen.

Another object of the present invention is to provide a game shooting machine and method that changes the progress of a game by changing the images of a game and adjusting the degree of difficulty of a game, based upon indicated coordinate detected by a player, rotation of a model gun or distance between a model gun and a screen.

Another object of the present invention is to provide a game shooting machine and method, which sets a reference distance between a model gun and a screen, and makes a game difficult if an actual distance is greater than the

reference distance and grants a benefit to the player if the actual distance is shorter than the reference distance.

Another object of the present invention is to provide a game shooting machine and method, in which indicated coordinates can be calculated using part of references by arranging a plurality of references according to a certain rule, so that indicated coordinates can not only be calculated in a wide range using a CCD camera of the same resolution but indicated coordinates can be also calculated in the same range using a CCD camera of a low resolution.

Another object of the present invention is to provide a game shooting machine and method, which sets a reference distance between a model gun and a screen, and increases the degree of difficulty by a reduction in the size of a mark, the imposition of penalty, an increase in the directional angle of a bullet, etc. if the actual distance is greater than the reference distance and gives a benefit to the player by increasing the size of a mark, providing an advantage, etc. if the actual distance is shorter than the reference distance.

In order to accomplish the above object, the present invention provides a shooting game machine, including display means for displaying images, including a mark; reference displaying means for displaying a plurality of references that are arranged inside or around the display means at irregular intervals and are bases for detection of coordinates; indication means for pointing at a point on the display mean, which is indicated by a player; image detecting means mounted on the indication means to detect an image of a region indicated by the indication means; reference coordinate detecting means for receiving the detected image and detecting coordinates of the references; indicated coordinate detecting means for detecting indicated coordinates indicated by the indication means based upon the detected coordinates of the references; and control means for adjusting a degree of difficulty based upon a distance between the display means and the indication means, receiving the detected indicated coordinates and controlling the entire shooting game machine.

Preferably, the irregular intervals between the plurality of references my

be determined depending upon conditions of the shooting game machine, such as a resolution of the display means, a resolution, a visible range and a rotation limit of the image detecting means, and the distance between the display means and the indication means.

Preferably, the reference coordinate detecting means may detect actual information of the detected references based upon ratios of distances between the detected references if the image detecting means detects part of the references.

Preferably, the indicated coordinate detecting means may detect indicated coordinates based upon two of part of the references detected by the image detecting means.

Preferably, the shooting game machine may further include rotation detecting means for detecting rotation of the indication means based upon the plurality of references.

Preferably, the control means controls the images displayed on the display means based upon a variation of the indicated coordinates detected by the indicated coordinate detecting means or the rotation detected by the rotation detecting means.

Preferably, the shooting game machine may further include a distance measuring means for detecting the distance between the display means and the indication means based upon previously stored intervals between the references on the display means and intervals between the references on the image detecting means, which are detected by the image detecting means.

Preferably, the control means may control the images displayed on the display means based upon a variation of the indicated coordinates detected by the indicated coordinate detecting means or the distance between the display means and the indication means detected by the distance detecting means.

Preferably, the control means may control the images displayed on the display means based upon a variation of the coordinates detected by the indicated coordinate detecting means.

Preferably, indication means includes an image generator, a translucent

reflecting mirror and a screen displaying an image reflected by the translucent reflecting mirror. The reference display means is positioned behind the translucent mirror.

Preferably, the indication means may be a model of one of a gun, a tennis racket, a baseball bat, a baton, a rod or a sword.

In order to accomplish the above object, the present invention provides a shooting game method, including the steps of (a) displaying images, including a mark, by a display means and displaying a plurality of references that are bases for detection of coordinates; (b) detecting a partial image of a certain region of a point indicated through an indication means manipulated by a player; (c) receiving the detected partial image, detecting coordinates of the references, and setting coordinates of the references to the detected coordinates of the references; (d) detecting indicated coordinates of the point indicated by the player based upon the coordinates of the references; (e) measuring a distance D between the display means and the indication means based upon previously stored intervals between the plurality of references and distances between the coordinates of the references; and (f) setting reference distances D_0 to some of distances D between the display means and the indication means falling within a certain range, and changing a degree of difficulty and situations of the game depending upon whether the reference distances are fulfilled.

Preferably, the distance D between the display means and the indication means may be calculated by the following equation $D \fallingdotseq f(L/d)$ where f denotes a focal length of a lens, L denotes a distance between the references obtained by previously stored coordinates of the references, and d denotes the intervals between the references on a CCD camera; wherein the indication means is equipped at the front end thereof with the lens and at the rear end thereof with the CCD camera.

Preferably, a directional angle δ_0 of the indicating means may be increased if the distance D is shorter than the reference distance D_0, while the

directional angle δ_0 of the indicating means may be reduced if the distance D is greater than the reference distance D_0.

Preferably, a size of the mark may be reduced if the distance D is shorter than the reference distance D_0, while the size of the mark may be increased if the distance D is greater than the reference distance D_0.

Preferably, a penalty may be granted to the player if the distance D is shorter than the reference distance D_0, while an advantage may be granted to the player if the distance D is greater than the reference distance D_0.

Preferably, the penalty may be granted to the player by a combination of a reduction in a moving speed of the player in the game, a limitation in a height of jumps and a reduction in game time.

Preferably, situations of the game may be set to be disadvantageous to the player if the distance D is shorter than the reference distance D_0, while the situations of the game may be set to be advantageous to the player if the distance D is greater than the reference distance D_0.

Brief Description of the Drawings

FIG. 1 is a perspective view of a prior art shooting game machine;

FIG. 2 is a perspective view of a shooting game machine in accordance with the present invention;

FIG. 3a is a schematic diagram in which a prior art model gun points at a screen, and FIG. 3b is a schematic diagram in which a model gun points at a screen in accordance with an embodiment of the present invention;

FIG. 4a is a diagram illustrating a prior art method of calculating coordinates, and FIG. 4b is a diagram illustrating a method of calculating coordinates in accordance with an embodiment of the present invention;

FIG. 5a is a diagram illustrating a prior art method of calculating coordinates when part of lamps fail, and FIG. 4b is a diagram illustrating a

method of calculating coordinates when part of lamps fail in accordance with an embodiment of the present invention;

FIG. 6 is a flowchart of an entire system according to the embodiment of the present invention;

FIG. 7 is a flowchart of a coordinate calculation algorithm according to an embodiment of the present invention;

FIG. 8a is a diagram showing the method of using the CCD camera according to the prior art, and FIG. 8b is a diagram showing the method of using the CCD camera according to an embodiment of the present invention;

FIG. 9 is a diagram showing the state in which a screen and an indicating means are spaced apart from each other;

FIG. 10 is a flowchart showing an example of a method of changing the degree of difficulty and situations of a game depending upon the distance between the screen and the indication means;

FIGS. 11a to 11e are flowcharts showing various examples in which the degree of difficulty and situations of a game are changed;

FIG. 12 is a diagram showing the state in which a bullet deviates when a trigger is pulled; and

FIGS. 13a and 13b are diagrams showing an example in which the size of a picture displayed on a screen is reduced.

<Description of reference numerals of principal elements in drawings>

1: game machine box	1a: screen
2: image generator	3: translucent reflecting mirror
4: infrared ray generating device	5: control means
6: coordinate detecting means	7: references
8: indicated coordinates	10: model gun
11: trigger	12: vibration-proof member
13: CCD camera	14: lens
15: infrared ray pass filter	16: communications line

Best Mode for Carrying Out the Invention

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings.

FIG. 2 is a perspective view of a shooting game machine according to the present invention.

A game machine box 1 contains elements constituting a game machine except for a model gun. A screen 1a is the device that displays a plurality of references that are the bases for the detection of content images, including a mark, and indicated coordinates. An image generator 2 is the device that generates images, including the contents of a game and a mark. A brown tub or projector is used for the image generator 2.

A display means for indicating a mark is constructed to include the screen 1a, the image generator 2 and a translucent mirror 3. The display means does not include the screen 1a and the translucent mirror 3, and may be constructed by installing the image generator 2 at the position of the screen 1a in FIG. 2.

The infrared ray generating device 4 is a reference displaying device for generating references that are the bases for the detection of coordinates indicated by the player, that is, indicated coordinates, employs infrared laser, and is positioned on the inside, outer periphery or back surface of the screen 1a.

The references generated by the reference displaying means are displayed on the inside or periphery of the screen 1a, and constitute bases for the detection of coordinates as will be described later.

The reason for using the infrared ray generating device 4 for a device for generating references is to accurately and clearly detect the references by displaying the references using infrared rays and passing lights through an infrared ray generating device 4 because the image of the game displayed on the screen 1a is composed of electromagnetic waves of an invisible ray and,

therefore, the references cannot be distinguished from the image of the game, as described above.

Further, since in the present invention, coordinates are calculated using references arranged at intervals determined by a certain rule as described later, unnecessarily detected points except for the references can be eliminated, thus further accurately detecting indicated coordinates.

The infrared generating unit 4 is positioned behind the translucent mirror 3, and the references are preferably arranged along a horizontal axis of the screen 1a passing through a center of the vertical axis of the screen 1a. The infrared ray references generated from the infrared ray generating device 4 passes through the translucent reflecting mirror 3 and are displayed on the screen 1a. In the case where the display means is constructed by positioning the image generator 2 on the position of the screen 1a without using the screen 1a and the translucent mirror 3, the infrared ray generating device 4 may be positioned on the periphery of the screen 1a or near the periphery of the screen 1a.

The control means 5 is a means for controlling the entire shooting game machine by transmitting images, including a mark, to the image generator 2 so that the player can see the images of the game, changing the contents of the game depending upon the motion of the player and determining whether the mark is hit for the management of the game. The control means 5 can be implemented using a general microprocessor.

The model gun 10 is an indication means for pointing at a point of the screen 1a indicated by the player, and may be replaced by a tennis racket, a baseball bat, a baton, a rod, a sword, etc.

The model gun 10 includes a CCD camera 13, a lens 14, an infrared ray filter 15, an image detecting means for detecting the image of a region indicated by the indication means, and a trigger 11 for allowing the shooting of the player to be noticed. The CCD camera may be replaced by a Complementary Metal-Oxide Semiconductor (CMOS) element.

The infrared ray pass filter 15 functions to receive the images of the

game, including the mark displayed on the screen 1a, eliminate the light of a visual ray range, and pass the electromagnetic waves of an infrared ray region therethrough.

The references composed of the electromagnetic waves of an infrared ray region are formed on the CCD camera 13 by the lens 14, converted into electric signals, and transmitted to a coordinate detecting means 6 via a communications line 16.

The coordinate detecting means 6 includes a reference coordinate detecting means for detecting the coordinates of the references using signals detected by the image detecting means and transmitted via the communications line 16 and an indicated coordinate detecting means for detecting indicated coordinates, which are indicated by the player through the indication means, based upon the coordinates of the references detected by the reference coordinate detecting means. The coordinate detecting means 6 includes a means for converting analog signals into digital signals when signals transmitted from the model gun 10 are analog signals.

The coordinate detecting means 6 may always detect the indicated coordinates to change the contents of the game depending upon the motion of the player while the game is played, or may detect the indicated coordinates on at the moment the trigger 11 is pulled to reduce the burdens of the operations of the control means 5 or the coordinate detecting means.

The indicated coordinates of a point, which is indicated by the player, detected by the indicated coordinate detecting means are transmitted to the control means 5, and are compared with the position coordinates of the mark at the moment the player pulls the trigger 11 to determine whether the player hits the mark.

The arrangement of the references is described as follows according to the present invention.

In the prior art shooting game machine, one or two references are employed. When three or more references are employed, they are used while

being arranged at regular intervals near the screen. In contrast, since the present invention employs the ratios of the distances of references, at least three references are arranged at predetermined intervals determined in consideration of the resolution of the screen 1a, the resolution, visible range (the range of the screen 1a that can be detected by the CCD camera at one time) and rotation limit (the maximum rotation angle that can be noticed when the player points at the image) of the CCD camera, and the resolution of the gun, that is, the range in which the model gun 10 can detect the screen 1a.

In the present invention, the process of accurately detecting coordinates of the references may be divided into the step of finding the actual information of the detected reference, that is, determining which position the detected references occupies in the order of references, and the step of detecting the indicated coordinates using the detected reference. In order to determine which position the detected reference occupies in the order of the references, the CCD camera 13 must always detect at least two distances, that is, at least three references. It is not necessary to detect all the references. Accordingly, the coordinates can be detected even using a CCD camera 13 of low resolution.

In order to always detect at least three of the plurality of references, the intervals between the references are determined in consideration of the resolution of the CCD camera 13 (a CCD camera of high resolution may be used when the interval between the references is great, and a CCD camera of low resolution may be used when the interval between the references is short), the rotation limit of the CCD camera 13, the resolution of the gun, the resolution of the screen 1a and the position where the player is mainly situated during the game, and the reference displaying means is adjusted so that the plurality of references are displayed according to the determined intervals.

For example, the case where the rotation limit of the CCD camera 13 is restricted to 30°, the entire screen 1a can be detected within a rotation range of 30°, but at least three references are not detected at the same time in the end portion of the screen 1a if the CCD camera 13 is rotated at more than 30°. Also,

the case where the standard position is arranged randomly, if indication means is closer than standard position, the image resolution capacity of CCD camera 13 becomes high. But if indication means is closer than any limit point, it is impossible to measure the end position of the screen.

In contrast, if the position of the indication means is far from a standard position, the image resolution capacity of the CCD camera 13 becomes low.

Since the size of the screen can be variously changed and the standard position is proportional to the actual size of the screen 1a, the intervals between the references are determined based on the resolution, visible range and rotation limit of the CCD camera and the resolution of the gun, and the constants for determining the size of the screen 1a and the standard position are produced according to the determined intervals. For example, if 150 cm is the standard position for the screen 1a of 73.66 cm (29 inch), 258 cm becomes the standard position for the screen 1a of 127 cm (50 inch). By the above-described method, the various arrangements of the references can maintain the same effect for the various sizes of the screen 1a.

Further, as the difference between the intervals between the references becomes greater, it becomes easier to distinguish the detected references from other references.

Although the plurality of references may be displayed near the periphery of the screen 1a by positioning the reference displaying means outside the periphery of the screen 1a, the plurality of references are preferably displayed on the inside of the screen 1a by positioning the reference displaying means behind the translucent reflection mirror 3, as illustrated in FIG. 2.

In the case where the plurality of references are arranged outside the screen 1a, the CCD camera 13 mounted on the model gun 10 to detect the image of a region indicated by the player must be mounted on the model gun 10 to be offset therefrom, as illustrated in FIG. 3a, so that the design of the model gun 10 is limited. In the case where the plurality of references are arranged on the inside of the screen 1a, the CCD camera 13 can be mounted on the model gun 10

to be aligned therewith, as illustrated in FIG. 3b, so that limitations in the design of the model gun 10 are eliminated.

The limitation in the arrangement of the references described above can be correctly expressed by the following mathematical equation (as shown in FIG. 4a, the case where the plurality of references are arranged along the horizontal axis of the screen 1a passing through the center of the vertical axis of the screen 1a is taken as an example).

A peripheral marginal error ET, which is the minimum distance required so that at least three references exist within a certain distance from the periphery of the screen 1a (or the periphery of a region in which the image is detected), and a general marginal error GT, which is a minimum distance required to detect at least three references when the inside region of the screen 1a, exclusive of the periphery of the screen 1a (or the periphery of the region in which the image is detected), is detected by the CCD camera, can be mathematically calculated.

If $D_1(\theta)$ and $D_2(\theta)$ are defined as $D_1(\theta)=\frac{S_H-C_H\cos\theta}{2\tan\theta}-\frac{C_H\sin\theta}{2}$ and $D_2(\theta)=\frac{\tan\theta(C_w\sin\theta-S_H)}{2}+\frac{C_w\cos\theta}{2}$ in the case where the horizontal value of the resolution of the model gun is S_W (not used because the references are indicated along the horizontal axis), the vertical value of the resolution of the model gun is S_H, the horizontal value of the resolution of the CCD camera is C_W, the vertical value of the resolution of the CCD camera is C_H, the rotation limit angle of the CCD camera is θ_C and the rotation angle of the CCD camera is θ ($0\le\theta\le\theta_C$), the minimums of the values calculated by the following equations become the values of ET and GT (if two or more conditions of the right side of $ET(\theta)$ are fulfilled at the same time, results are calculated)

$$ET(\theta)=\begin{cases} not-defined & ((\frac{S_H}{2})^2+(D_2(\theta))^2\ge(\frac{C_H}{2})^2+(\frac{C_w}{2})^2) \\ not-defined & (D_2(\theta)<0) \\ |D_1(\theta)| & (|D_1(\theta)|<|D_2(\theta)|) \\ |D_2(\theta)| & (|D_1(\theta)|\ge|D_2(\theta)|) \end{cases}$$

$$GT(\theta)=\begin{cases} not-defined & ((\frac{S_H}{2})^2+(D_2(\theta)^2 \geq (\frac{C_H}{2})^2+(\frac{C_w}{2})^2) \\ D_2(\theta)-D_1(\theta) & otherwise \end{cases}.$$

If $ET(\theta)$ and $GT(\theta)$ values are not calculated at $\theta\ (0 \leq \theta \leq \theta_C)$ (not defined), $ET(\theta)$ and $GT(\theta)$ do not exist.

The reference are arranged to allow the intervals between the references to be maximized within the range that fulfills the conditions of $ET(\theta)$ and $GT(\theta)$. For example, since ET and GT are 58.58 and 142.99, respectively, in the case where the limit angle is 15°, at least three references are arranged within a distance of 58.58 from the periphery of the screen 1a, and continuous three references are arranged within a distance of 142.99 to allow the intervals between the references to be maximized.

A more accurate calculation of coordinates is possible by arranging the references based upon values mathematically calculated according to the resolution and visible range of the CCD camera 13, the resolution of the model gun, the resolution of the screen 1a and the standard position.

FIG. 8a is a diagram showing the method of using the CCD camera according to the prior art, and FIG. 8b is a diagram showing the method of using the CCD camera according to an embodiment of the present invention.

A practical, mass-produced and generally used CCD is fabricated in a ratio of 4:3 to be consistent with the ratio of a horizontal side to a vertical side of commercially used televisions and monitors (320×240, 352×288, 400×300, and 640×480). CCDs having resolutions (360×240 and 720×480), in which the number of the pixels on the longitudinal axis is greater than that of the transverse axis, are used.

Citing a CCD having a resolution of 320×240 as an example, the resolution, which can best detect the image, of the model gun 10 used in the prior art shooting game machine is 320×240 because the longitudinal axis having more pixels is positioned along the horizontal direction, as illustrated in FIG. 8a.

However, if the longitudinal axis having more pixels is positioned along the vertical direction according to the embodiment of the present invention, as illustrated in FIG. 8b, that is, the CCD is used after being rotated at 90°, the references are closely arranged along the horizontal direction according to the certain rule, so that the image detection resolution 80 of the longitudinal axis has no problems. Accordingly, the resolution of the transverse axis positioned along the horizontal direction is 427 (320×4/3) when a ratio of the general screen 1a of 4:3 is applied.

As a result, even though the prior art CCD is employed, the resolution can increase by (427×320)/(320×240)=136,640/76,800=178%, so that the image detection resolution can increase by 178%.

Hereinafter, the operation of the embodiment of the present invention is described based upon the above-described construction.

FIG. 6 is a flowchart of an entire system according to the embodimcnt of the present invention.

When the player points at the mark displayed on the screen 1a while holding the model gun 10 in this hands at step S00 and S01, the references are detected by the CCD camera 13 mounted on the model gun 10 at step S02.

The references detected by the CCD camera 13 are transmitted to the coordinate detecting means 6 via the communications line 16, and points disturbing the references are eliminated by the coordinate detecting means 6 at step S03. The elimination of the points is made possible by determining whether each detected point is a reference in such a way as to compare the detected points with the information of the references because the information of the references is previously stored in the shooting game machine.

It is determined whether the number of points remaining after the elimination of the disturbing points is three or more at step S04. The reason for this is that the detection of coordinates of the present invention is possible when the number of detected references is three or more.

If the number of the remaining points is three or more, the indicated

coordinates are calculated using a coordinate calculation algorithm that will be described later, and the distance between the screen 1a and the player and the rotation angle of the model gun 10 are calculated at step S05. If the number of the remaining points is less than three, the process returns to the initial step.

The indicated coordinates, the distance between the screen 1a and the player and the rotation angle of the model gun 10 are transmitted to the control means 5, and are reflected by the contents of the game including the images and the size of the mark.

Thereafter, it is determined whether the player has pulled the trigger at step S06. If the player has not pulled the trigger, the process returns to the initial step. If the player has pulled the trigger, it is determined whether the mark is hit by comparing the indicated coordinates at that moment with the coordinates of the mark at step S07. Finally, it is determined whether the game is terminated, and if a termination signal is not detected, the process returns to the initial step at step S08.

FIG. 7 is a flowchart of a coordinate calculation algorithm according to an embodiment of the present invention.

There is taken as an example of the case where the screen 1a has the resolution that can be plotted in a range from 0 to 400 in a horizontal direction, the CCD camera 13 has a resolution of 320×240 and is used with the side thereof having high resolution positioned along a vertical direction (accordingly, the central coordinates of the CCD camera are (120, 160)) and the references are arranged at the positions of (19, 43, 58, 141, 175, 200, 225, 259, 342, 357, 381).

The positions of the references are previously stored in the shooting game machine, the intervals between neighboring references are (24, 15, 83, 34, 25, 25, 34, 83, 15, 24), and the ratios of the intervals neighboring references are (0.625000, 5.533333, 0.409638, 0.735294, 1.000000, 1.360000, 2.441176, 0.180722, 1.60000).

The process of detecting coordinates by sensing the motion, in which the player points the model gun 10 at the screen 1a or rotates the model gun 10, starts

only if the number of references input through the CCD camera 13 is more than three at step S001.

If the number of previously input references is more than three, the intervals between the references are calculated at step S002.

When the distances between neighboring references are calculated, the ratios between the intervals between neighboring references are sequentially calculated at step S003.

If the number of the input references is three after the ratios of the intervals between neighboring references are calculated, references having a ratio most appropriate to a given interval ratio at steps S003 and S015. If in the above example, three references are input and the interval ratio is 0.42, 0.409638 is a closest value and the detected references are considered third, fourth and fifth references.

If the number of input references is four or more, references at positions where the sums of the errors for the given ratios of the intervals are least are found at steps S003 and S025. If in this example, five references are input and the ratios of the intervals are 0.74, 1.33 and 2.42 in the order of size, the detected references are fourth, fifth, sixth and seventh references, since the least errors are 0.735294, 1.360000 and 2.441176 when continuous references are extracted from the ratios of the intervals and compared with one another.

In this case, in the case where a seventh reference is not detected due to the partial failure of the reference displaying means, fourth, fifth and sixth references are detected, so that the calculation of coordinates is possible.

The coordinates of the references are detected by the reference coordinate detecting means based upon the references detected as described above, and the indicated coordinates of a point indicated by the player can be obtained by the following method at step S006.

The number of references used to calculate coordinates is two. When three references are detected, left two references are used to calculate coordinates. When four or more references are detected, it is preferable to calculate the

indicated coordinates using two references, including a reference that is closest to the center of the CCD camera 13 and a reference beside the closest reference.

If the coordinates of two references (it is assumed that an left upper corner is an origin) on the CCD camera 13, which are used for the calculation, are $p_1 = (p_{1X}, p_{1Y})$ and $p_2 = (p_{2X}, p_{2Y})$, the coordinates of the center of the CCD camera 13 are $C = (C_X, C_Y)$, predetermined values corresponding to the references are I_1 and I_2 in the order of size, and e and d are defined as $e = (p_{1Y} - p_{2Y}, p_{2X} - p_{1X})$ and $d = \sqrt{(p_{2X} - p_{1X})^2 + (p_{2Y} - p_{1Y})^2}$, respectively, the X coordinate and the Y coordinate are calculated using $\left[(I1 + (I2 - I1)\frac{C(p_2 - p_1)}{d}\right]$ and $\left[(I2 - I1)\frac{C^* e}{d}\right]$, respectively. In this case, the calculation equations of the X and Y coordinates are obtained after it is assumed that a lamp is positioned at the center of a monitor. If the lamp is not positioned at the center, the calculation equations may be different.

If it is assumed that the origin of coordinates on the screen 1a is the intersection between an extension line from the reference and the left side of the screen 1a, previously defined values I_1 and I_2 preferably are the coordinates of the horizontal axis of the screen 1a. For example, when the indicated coordinates are calculated using third and fourth references, the values of I_1 and I_2 are 58 and 121, respectively.

After the indicated coordinates indicated by the player are calculated, the rotation angle of the indication means is obtained by calculating how much the indication means is inclined based upon the coordinates of found references and the previously input coordinates of references at step S007. The rotation angle is calculated by the equation $\cos^{-1}((p_{2X}-p_{1X}) / \sqrt{d})$ (radian). If the sign of $(p_{2X} - p_{1X})(p_{2X} - p_{1Y})$ is positive, the positive sign means that the indication means has been rotated to the right. If the sign of $(p_{2X} - p_{1X})(p_{2X} - p_{1Y})$ is

negative, the negative sign means that the indication means has been rotated to the left.

After the rotation angle of the indication means is calculated, the distance between the found references on the CCD camera 13 and the actual distance between the references on the screen 1a obtained by the previously input coordinates of references are measured at step S008.

When the distance between the screen 1a and the indication means and the distance between the found references on the CCD camera 13 are D and d, respectively, and the focal length of the lens 14 and the distance between references obtained based upon the previously input coordinates of the references are f and L, respectively, the distance D between the screen 1a and the indication means is obtained by $D \fallingdotseq f(L/d)$.

The process of changing the degree of difficulty and the situations of the game depending upon the distance D between the screen 1a and the indication means is illustrated in FIG. 10.

Referring to FIG. 10, the player shoots the model gun 10 while pointing the model gun 10 at the mark on the screen 1a at step S100. At this time, as the position of the model gun 10 is changed, the distance D between the model gun 10 and the screen 1a is continuously measured in the shooting game machine at step S102.

The shooting game machine determines whether the measured distance D is appropriately maintained at step S103. That is, as shown in FIG. 9, the distance between the screen 1a and the indication means may be changed depending upon the action of the player. Let the appropriate distance be defined as a reference distance D_0. At this time, when the reference distance D_0 is not a point but a distance having a certain variation range, the variation range is set to $D_{0a} \sim D_{0b}$. If the distance D is measured and the measured distance D falls within the variation range, a normal state is maintained and a normal game is provided at step S104. If the measured distance D does not satisfies the variation range, that is, the measured distance D is a shorter distance D_1 or greater distance D_0, the

degree of difficulty or the situations of the game are changed at step S105. That is, the game environment of a different condition is provided depending upon a distance from the model gun 10, which induces the player to have an interest in the game.

Specified examples of changing the degree of difficulty of the game or the situations of the game are disclosed in FIGS. 11a to 11e. FIGS. 11a to 11e are flowcharts showing the various examples for changing the degree of difficulty of the game or the situations of the game.

Referring to FIG. 11a, if the distance D is less than the variation range after evaluating the distance D at step S110 and the variation range D_{0a}~D_{0b}, that is, the model gun 10 is positioned close to the screen 1a (for example, the model gun 10 is spaced from the screen 1a by the distance D_1), a bullet is made to deviate from the mark when the player pulls the trigger 11 at step S111. That is, the bullet does not hit the mark at which the player points and hits coordinates that are offset from the mark in a certain direction. This induces the effect of reducing the possibility of hitting the mark when the player shoots the model gun 10. In this case, another object other than the mark may be hit. The equation of a specified example of this point is as follows. The view of this point is illustrated in FIGS. 12a and 12b. FIG. 12a shows the trace of a bullet when only a pure error angle δ_S that the model gun 10 has exists. FIG. 12b shows an error angle δ_S when the pure error angle δ_S not only exists but also the shooting game machine causes a bullet to deviates. The equation exemplarily supporting this point is disclosed as below. This equation is only an example to give an explanation, and may be freely modified.

$$\delta_0 = \begin{bmatrix} \left(\delta_S + \tan^{-1}(k \times |d_S - d|\right) & (d < d_S) \\ \delta_S & otherwise \end{bmatrix}$$

δ_S : error angle that model gun basically has

d_S : critical distance between model gun and screen

k: constant determined depending upon model gun

In contrast, if the distance D is greater than any of the distances of the variation range, the action of increasing shooting accuracy is taken at step S112. That is, even though the bullet hits a position away from the mark, the bullet may be considered to have hit the mark.

Referring to FIG. 11b, if the distance D is less than any of the distances of the variation range after evaluating the distance D and the variation range D_{0a}~D_{0b} at step S120, the size of the mark is reduced when the player pulls the trigger 11 at step S121. That is, the same or tough conditions are provided regardless of the position of the model gun 10 by adjusting the size of the mark depending upon the distance from the model gun 10, which reduces the probability of hitting the mark. An exemplary equation regarding this is disclosed below.

$$L' = \begin{cases} L \times k \times |d_s - d| & (d < d_s) \\ L & otherwise \end{cases}$$

L': reduced length

d_s: critical distance between model gun and screen

k: constant set according to object

On the contrary, if the distance D is greater than any of the distances of the variation range, the action of increasing shooting accuracy by increasing the size of the mark at step S122.

Referring to FIG. 11c, if the distance D is less than any of the distances of the variation range after evaluating the distance D and the variation range D_{0a}~D_{0b} at step S130, a penalty is granted to the player when the player pulls the trigger 11 at step S131. The granting of the penalty can be variously exemplified by preventing the player from adapting himself to the game environment in such a way as to considerably reduce the moving speed of the

player in the game environment within a certain time, making continuous shootings difficult in such a way as to limit the height of a jump when the player jumps in the game environment or to increase the intervals between shootings, or preventing the player from easily following the mark in such a way as to increase the moving speed of the mark. On the contrary, if the distance D is greater than any of the distances of the variation range, a normal game is provided to the player, as usual, at step S132, or an advantage is granted to the player.

Referring to FIG. 11d, if the distance D is less than any of the distances of the variation range after evaluating the distance D and the variation range D_{0a}~D_{0b} at step S140, the size of a picture displayed on the screen 1a is reduced at step S141. This reduces the size of the sight of the mark and, accordingly, the size of the mark is reduced. On the contrary, if the distance D is greater than any of the distances of the variation range, the size of the mark is increased at step S142. That is, as the distance is lengthened, the size of the mark is enlarged in proportion to the lengthened distance, so that the ability of the player is maintained. An example of the above-described process is shown in FIGS. 13a and 13b. FIG. 13a shows the size of the picture displayed on the screen 1a when the model gun 10 is positioned far from the screen 1a, and FIG. 13b shows the size of the picture displayed on the screen 1a when the model gun 10 is positioned close to the screen 1a.

Referring to FIG. 11e, the distance D and the variations D_{0a}~D_{0h} are evaluated at step S150. If the distance D is less than any of the distances of the variations D_{0a}~D_{0h}, the situations of the game are changed when the player pulls the trigger 11 at step S151. The situations of the game denote the set or background of the game, which indirectly affects the game. In contrast, if the distance D is greater than any of the distances of the variations, the player is made to easily point at the mark by clarifying the contour of the mark while maintaining the same set and background at step S152.

As described above, the present invention can accurately calculate the point on the screen 1a at which the player points while holding the indication

means, that is, the model gun 10. An accurate calculation of the indicated coordinates is possible even in the case where the rotation of the model gun 10 is taken into account.

Further, the method of detecting the indicated coordinates can calculate indicated coordinates even when the CCD camera 13 detects part of the references. Accordingly, as shown in FIG. 4b, the indicated coordinates can be detected in a wide range even using the CCD camera 13 having a CCD of the same resolution. The indicated coordinates can be calculated in the same range using the CCD camera of a low resolution.

Further, in the case where part of the reference displaying means fails and part of the references cannot be displayed, it is impossible for the prior art shooting game machine to calculate the indicated coordinates, as shown in FIG. 5b. In the present invention, as shown in FIG. 5b, although part of the infrared ray generating device 4 fails and part of the references are not displayed, the point indicated by the player, rotation and the distance between the screen 1a and the indication means can be calculated, thus increasing the duration of the shooting game machine.

Further, the present invention can calculate the degree of rotation of the indication means and the distance between the screen 1a and the indication means, and the control means 5 can adjust the degree of difficulty of the game and voluntarily change the images of the game based upon the calculated degree and distance.

That is, if the player approaches the screen 1a, the player can easily hit the mark, so that the control means 5 can increase the degree of difficulty by increasing the moving speed of the mark or reducing the size of the mark. In contrast, if the player goes away from the screen 1a, the control means 5 can reduce the degree of difficulty by reducing the moving speed of the mark or increasing the size of the mark.

Further, the prior shooting game machine manages the game regardless of the motion of the player, but the control means 5 of the present invention

changes the images of the game while reflecting the rotation or movement of the indication means or the distance from the indication means.

Accordingly, since the player can enjoy a game with the degree of difficulty and progress of the game changed in response to the motion of the player, the player can enjoy a more realistic shooting game.

The present invention is not limited to the above-described embodiments, and can allow various modifications and alterations performed by those skilled in the art. The various modifications and alterations fall within the scope and spirit of the invention defined by the accompanying claims.

Industrial Applicability

As described above, the present invention causes the player to have a great interest in the game by changing a game environment depending upon the distance between the model gun and the screen.

The present invention increases interest in the game by changing the progress of the game in such a way as to change the images of the game or making the degree of difficulty different.

Further, the present invention provides the effect of enabling the fair management of games because a game is made difficult if the actual distance is shorter than the reference distance set between the model gun and the screen and a benefit is granted to the player if the actual distance is greater than the reference distance. For example, if the actual distance is shorter than the reference distance, the degree of difficulty is increased by a reduction in the size of the mark, the imposition of a penalty, an increase in the directional angle of a bullet, etc. If the actual distance is greater than the reference distance, a benefit may be granted to the player by increasing the size of the mark, providing an advantage, etc.

Accordingly, the player can enjoy the game with the degree of difficulty and progress of the game changed in response to the rotation of the model gun

manipulated by the player or the variation of the distance, so that the present invention exhibits an effect of providing a realistic shooting game.

Further, since indicated coordinates can be calculated using only part of references by arranging a plurality of references according to a certain rule, indicated coordinates can not only be calculated in a wide range using a CCD camera of the same resolution but indicated coordinates can be also calculated in the same range using a CCD camera of a low resolution.

Claims

1. A shooting game machine, comprising:

display means for displaying images, including a mark;

reference displaying means for displaying a plurality of references that are arranged inside or around the display means at irregular intervals and are bases for detection of coordinates;

indication means for pointing at a point on the display mean, which is indicated by a player;

image detecting means mounted on the indication means to detect an image of a region indicated by the indication means;

reference coordinate detecting means for receiving the detected image and detecting coordinates of the references;

indicated coordinate detecting means for detecting indicated coordinates indicated by the indication means based upon the detected coordinates of the references; and

control means for adjusting a degree of difficulty based upon a distance between the display means and the indication means, receiving the detected indicated coordinates and controlling the entire shooting game machine.

2. The shooting game machine as set forth in claim 1, wherein the irregular intervals between the plurality of references are determined depending upon conditions of the shooting game machine, such as a resolution of the display means, a resolution, a visible range and a rotation limit of the image detecting means, and the distance between the display means and the indication means.

3. The shooting game machine as set forth in claim 1, wherein the reference coordinate detecting means detects actual information of the detected references based upon ratios of distances between the detected references if the image detecting means detects part of the references.

4. The shooting game machine as set forth in claim 1 or 3, wherein the indicated coordinate detecting means detects indicated coordinates based upon two of part of the references detected by the image detecting means.

5. The shooting game machine as set forth in claim 1, further comprising rotation detecting means for detecting rotation of the indication means based upon the plurality of references.

6. The shooting game machine as set forth in claim 5, wherein the control means controls the images displayed on the display means based upon a variation of the indicated coordinates detected by the indicated coordinate detecting means or the rotation detected by the rotation detecting means.

7. The shooting game machine as set forth in claim 1, further comprising a distance measuring means for detecting the distance between the display means and the indication means based upon previously stored intervals between the references on the display means and intervals between the references on the image detecting means, which are detected by the image detecting means.

8. The shooting game machine as set forth in claim 7, wherein the control means controls the images displayed on the display means based upon a variation of the indicated coordinates detected by the indicated coordinate detecting means or the distance between the display means and the indication means detected by the distance detecting means.

9. The shooting game machine as set forth in claim 1, wherein the control means controls the images displayed on the display means based upon a variation of the coordinates detected by the indicated coordinate detecting means.

10. The shooting game machine as set forth in claim 1, wherein the indication means is a model of one of a gun, a tennis racket, a baseball bat, a baton, a rod or a sword.

11. A shooting game method, comprising the steps of:

(a) displaying images, including a mark, by a display means and displaying a plurality of references that are bases for detection of coordinates;

(b) detecting a partial image of a certain region of a point indicated through an indication means manipulated by a player;

(c) receiving the detected partial image, detecting coordinates of the references, and setting coordinates of the references to the detected coordinates of the references;

(d) detecting indicated coordinates of the point indicated by the player based upon the coordinates of the references;

(e) measuring a distance D between the display means and the indication means based upon previously stored intervals between the plurality of references and distances between the coordinates of the references; and

(f) setting reference distances D_0 to some of distances D between the display means and the indication means falling within a certain range, and changing a degree of difficulty and situations of the game depending upon whether the reference distances are fulfilled.

12. The shooting game method as set forth in claim 11, wherein the distance D between the display means and the indication means is calculated by the following equation

$$D \fallingdotseq f(L/d)$$

where f denotes a focal length of a lens, L denotes a distance between the references obtained by previously stored coordinates of the references, and d denotes the intervals between the references on a CCD camera;

wherein the indication means is equipped at the front end thereof with the

lens and at the rear end thereof with the CCD camera.

13. The shooting game method as set forth in claim 11, wherein a directional angle δ_0 of the indicating means is increased if the distance D is shorter than the reference distance D_0, while the directional angle δ_0 of the indicating means is reduced if the distance D is greater than the reference distance D_0.

14. The shooting game method as set forth in claim 11, wherein a size of the mark is reduced if the distance D is shorter than the reference distance D_0, while the size of the mark is increased if the distance D is greater than the reference distance D_0.

15. The shooting game method as set forth in claim 11, wherein a penalty is granted to the player if the distance D is shorter than the reference distance D_0, while an advantage is granted to the player if the distance D is greater than the reference distance D_0.

16. The shooting game method as set forth in claim 15, wherein the penalty is granted to the player by a combination of a reduction in a moving speed of the player in the game, a limitation in a height of jumps and a reduction in-game time.

17. The shooting game method as set forth in claim 11, wherein situations of the game are set to be disadvantageous to the player if the distance D is shorter than the reference distance D_0, while the situations of the game are set to be advantageous to the player if the distance D is greater than the reference distance D_0.

FIG.1

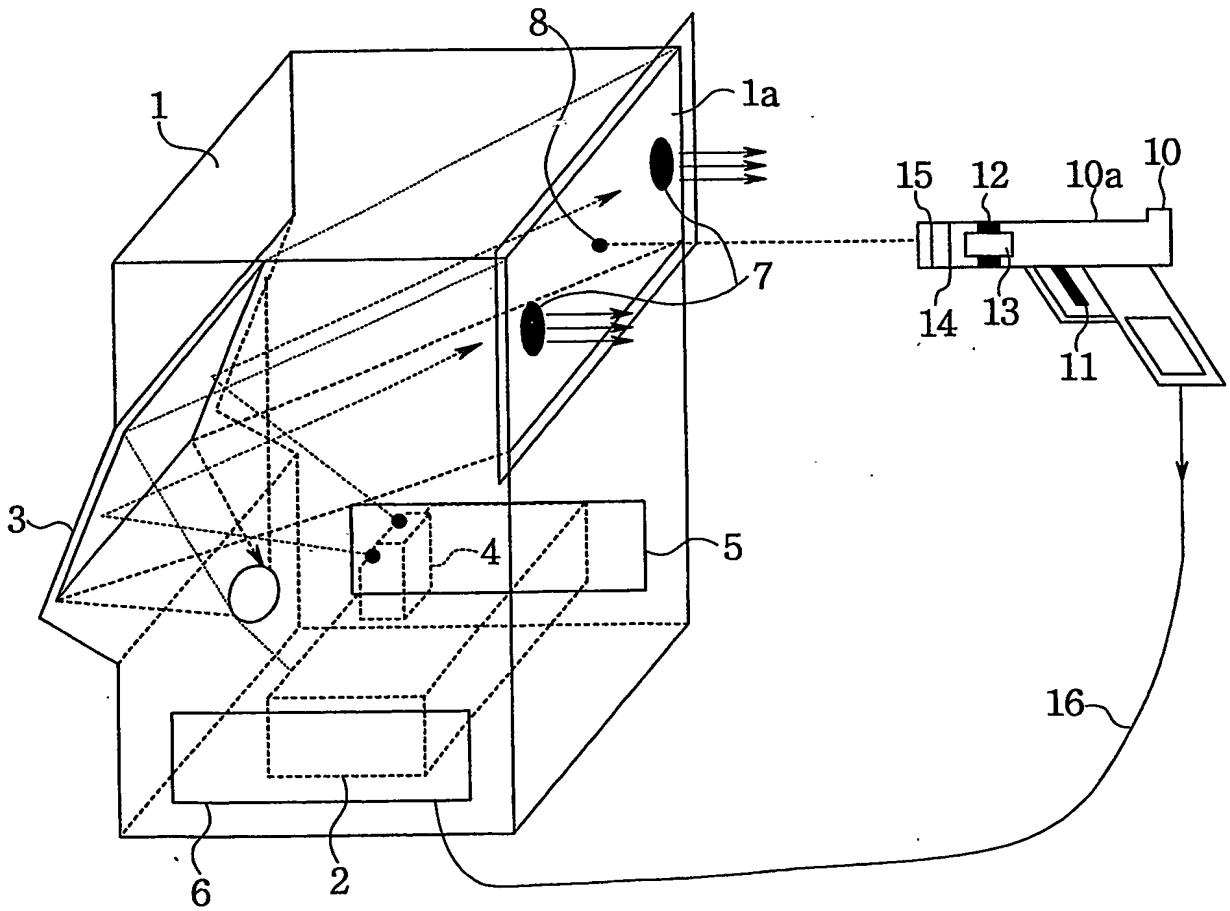


FIG.2

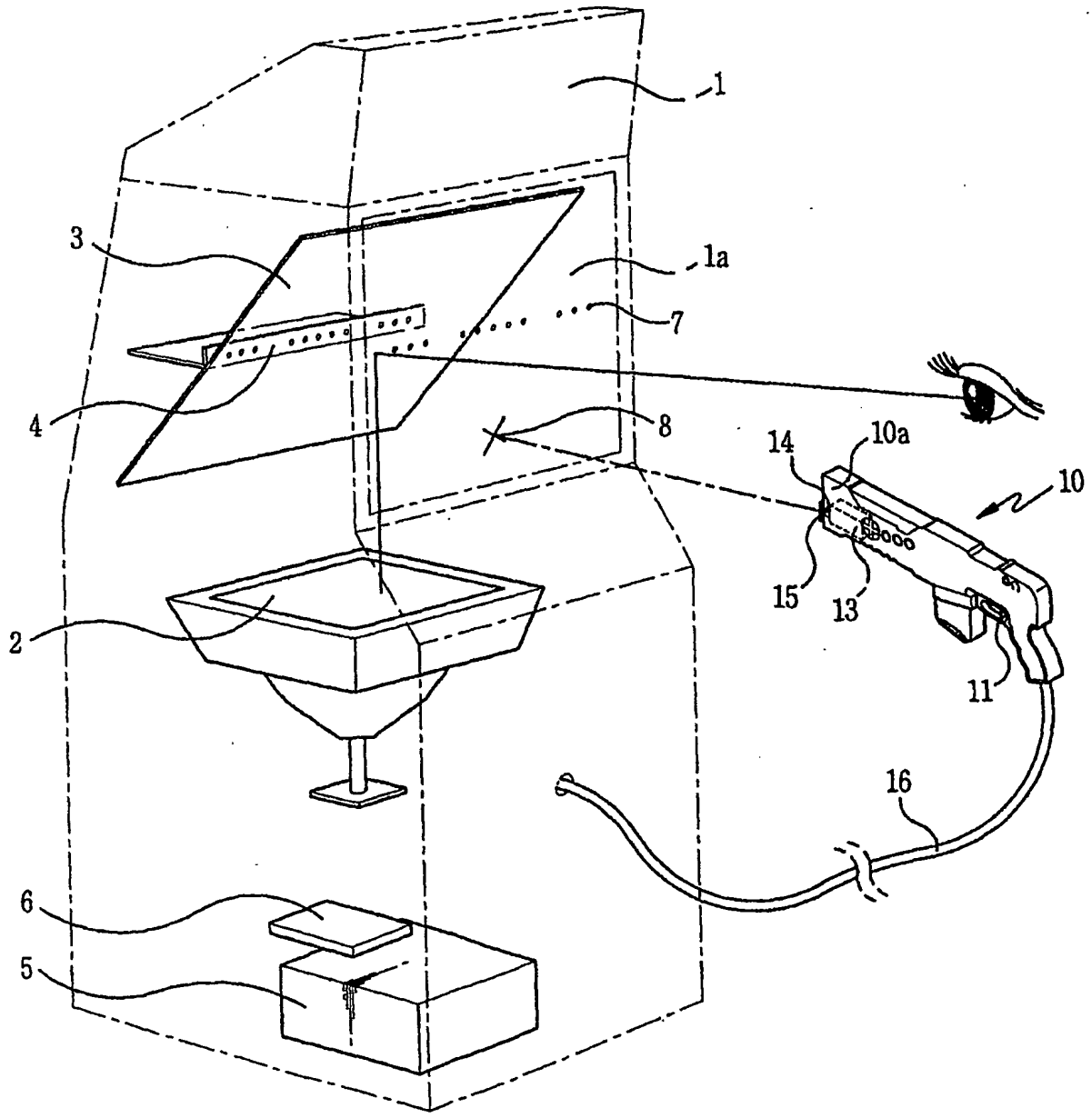


FIG.3a

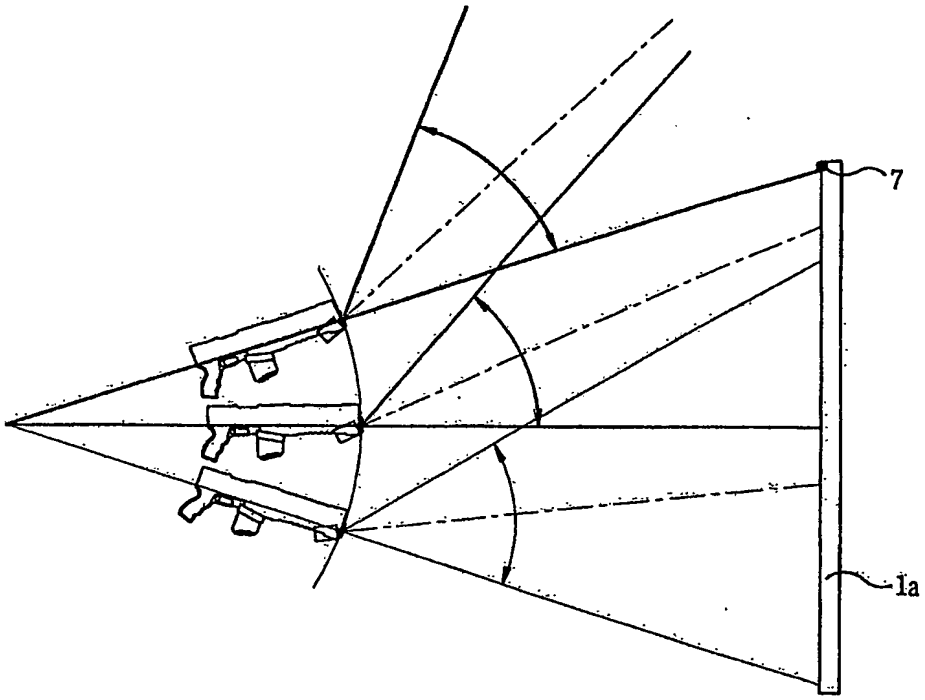


FIG.3b

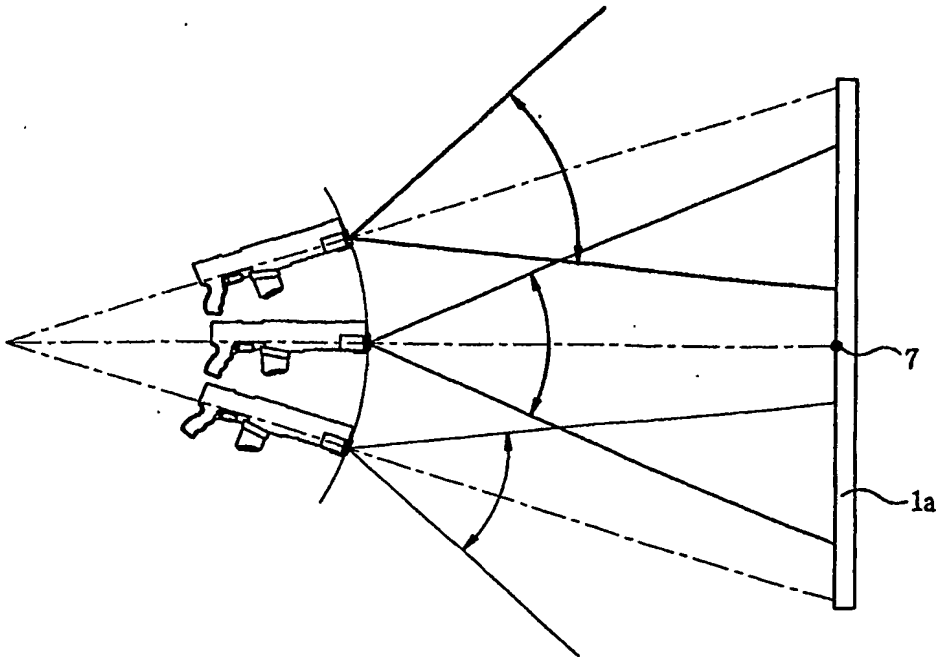


FIG.4a

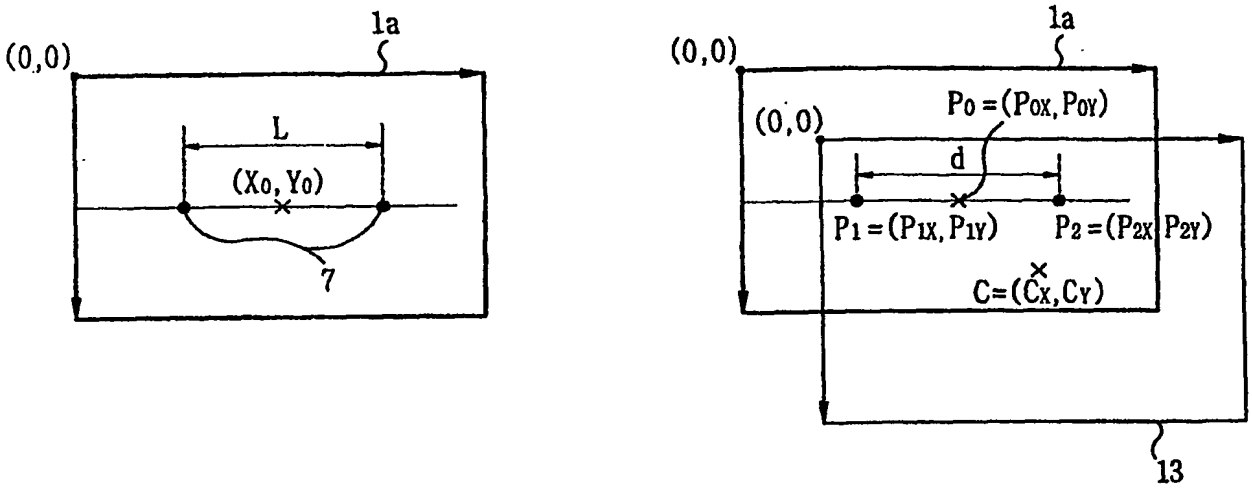

1a
(0,0)
L
(X0, Y0)
7
1a
(0,0)
P0 = (P0X, P0Y)
(0,0)
d
P1 = (P1X, P1Y)
P2 = (P2X, P2Y)
C=(CX, CY)
13

FIG.4b

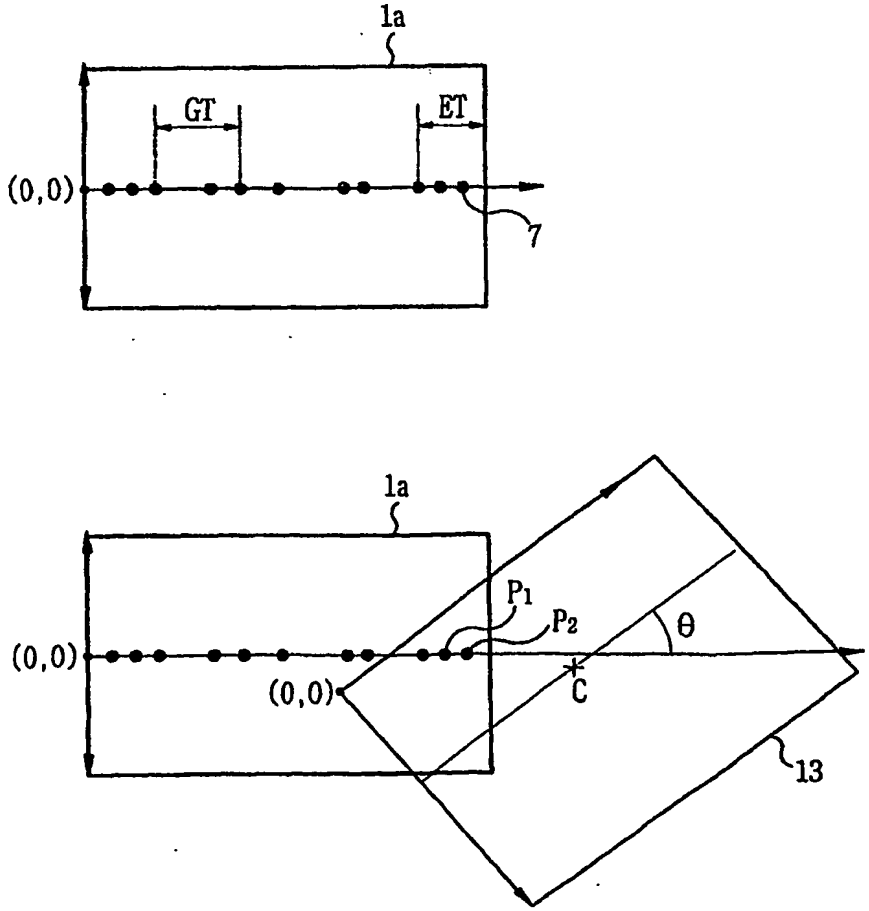

1a
GT
ET
(0,0)
7
1a
P1
P2
θ
(0,0)
(0,0)
C
13

FIG.5a

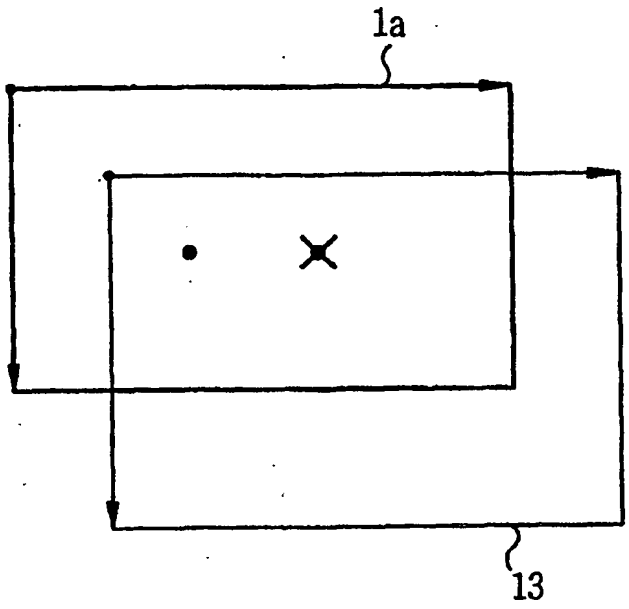


FIG.5b

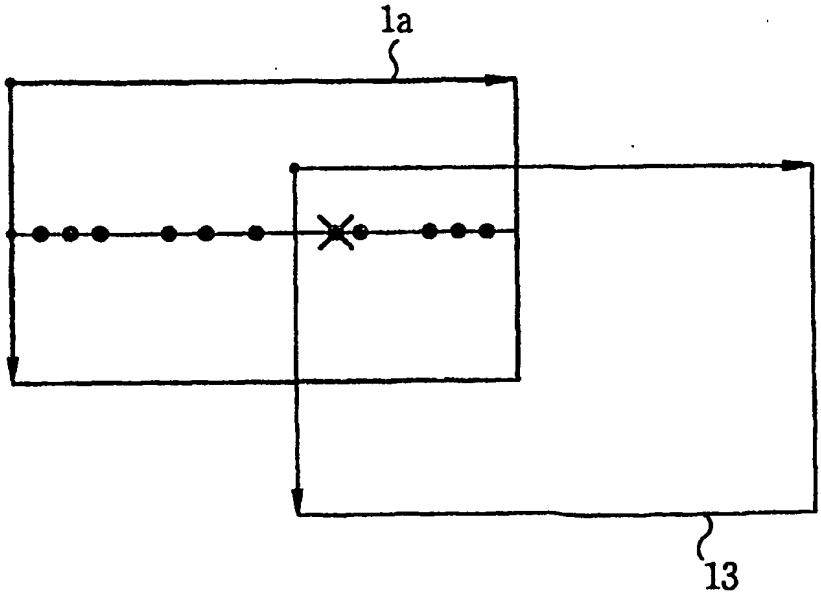


FIG.6

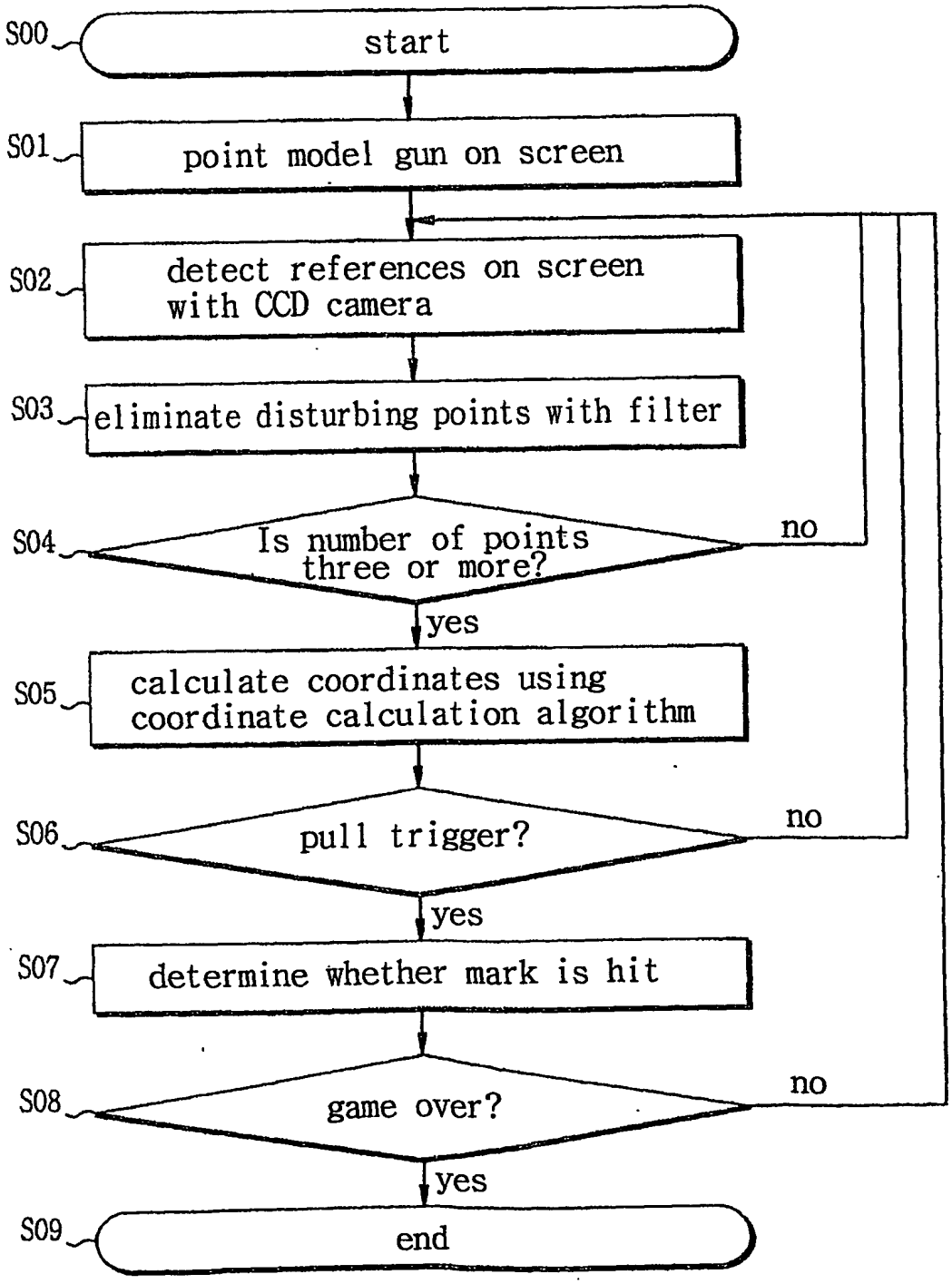

S00
start
S01
point model gun on screen
S02
detect references on screen with CCD camera
S03
eliminate disturbing points with filter
S04
Is number of points three or more?
no
yes
S05
calculate coordinates using coordinate calculation algorithm
S06
pull trigger?
no
yes
S07
determine whether mark is hit
S08
game over?
no
yes
S09
end

FIG.7

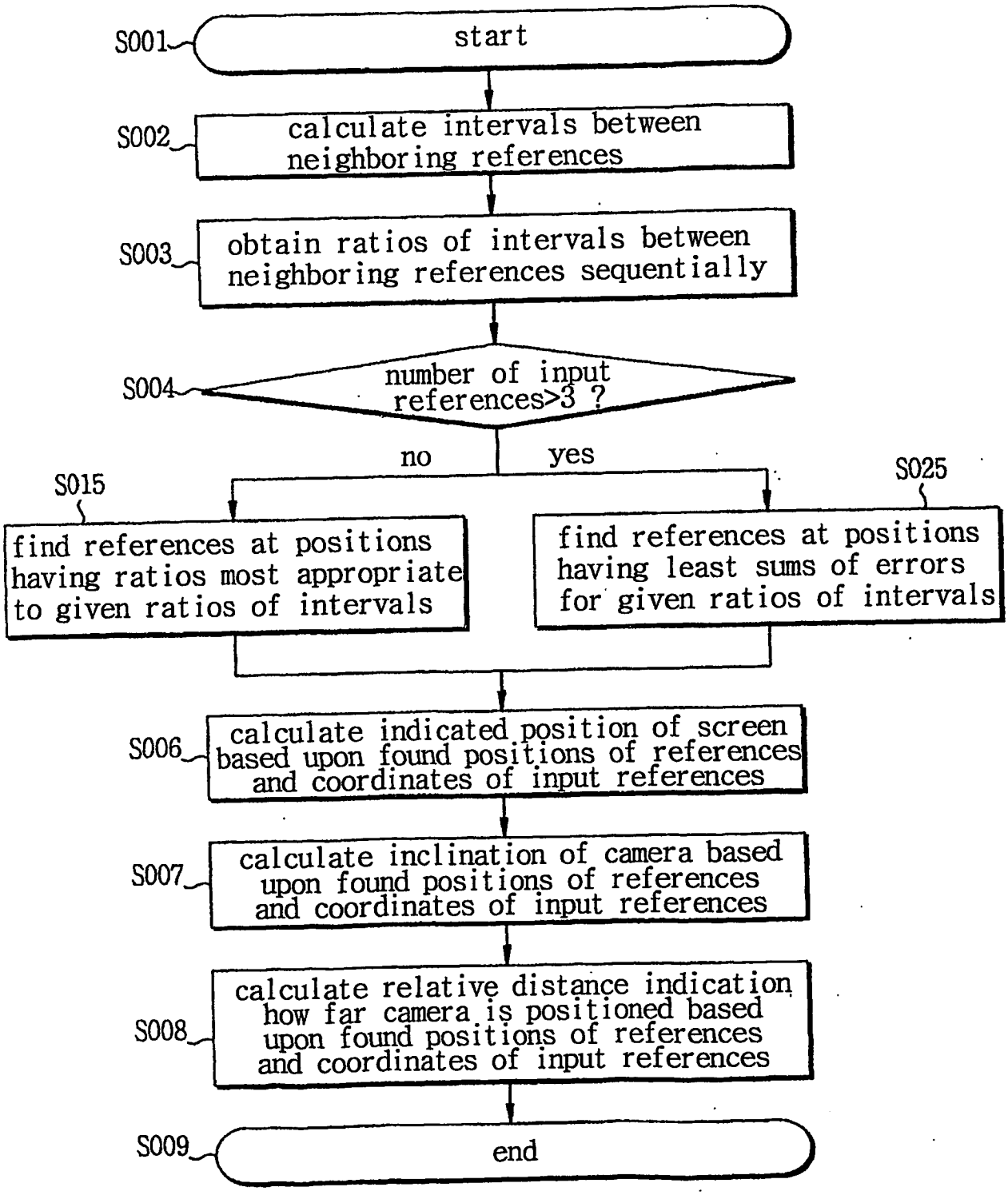

S001
start
S002
calculate intervals between neighboring references
S003
obtain ratios of intervals between neighboring references sequentially
S004
number of input references>3 ?
no
yes
S015
find references at positions having ratios most appropriate to given ratios of intervals
S025
find references at positions having least sums of errors for given ratios of intervals
S006
calculate indicated position of screen based upon found positions of references and coordinates of input references
S007
calculate inclination of camera based upon found positions of references and coordinates of input references
S008
calculate relative distance indication how far camera is positioned based upon found positions of references and coordinates of input references
S009
end

FIG.8a

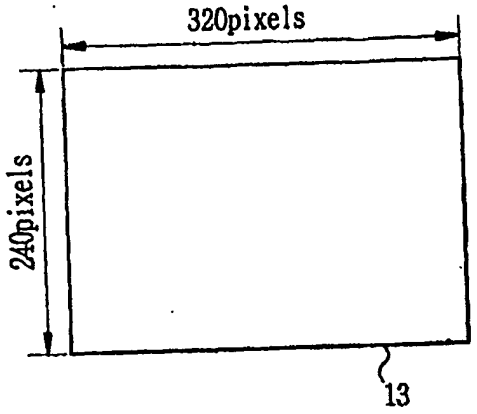


FIG.8b

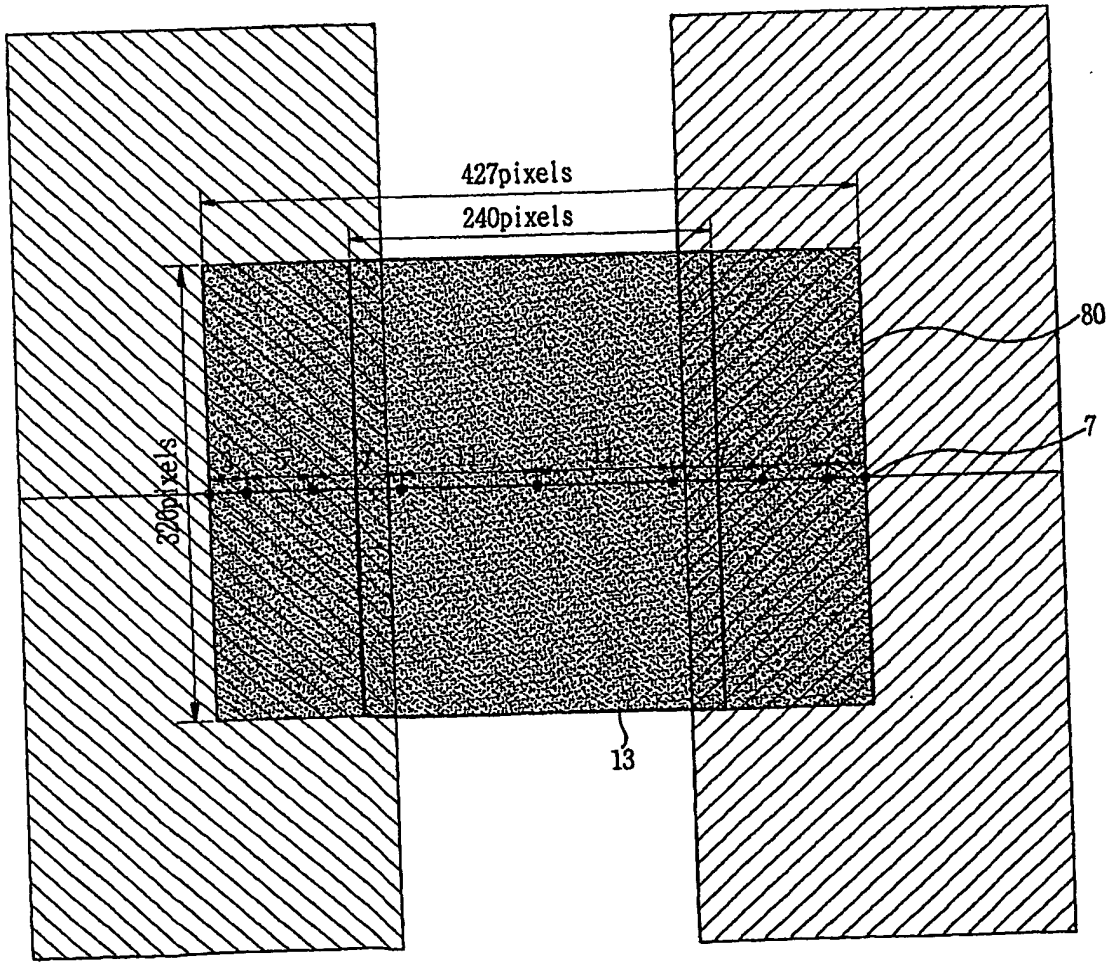


FIG.9

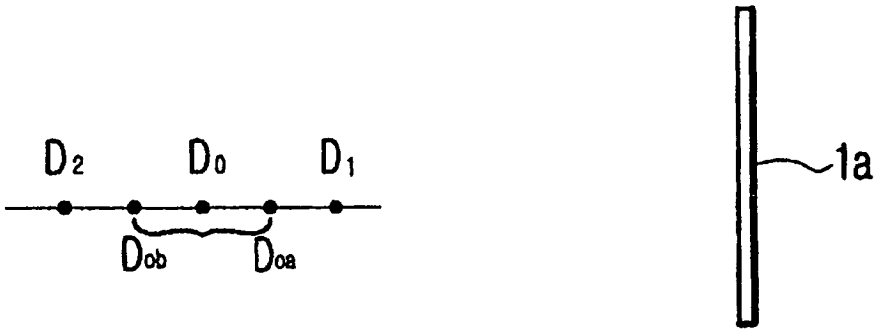

D2
D0
D1
Dob
Doa
1a

FIG.10

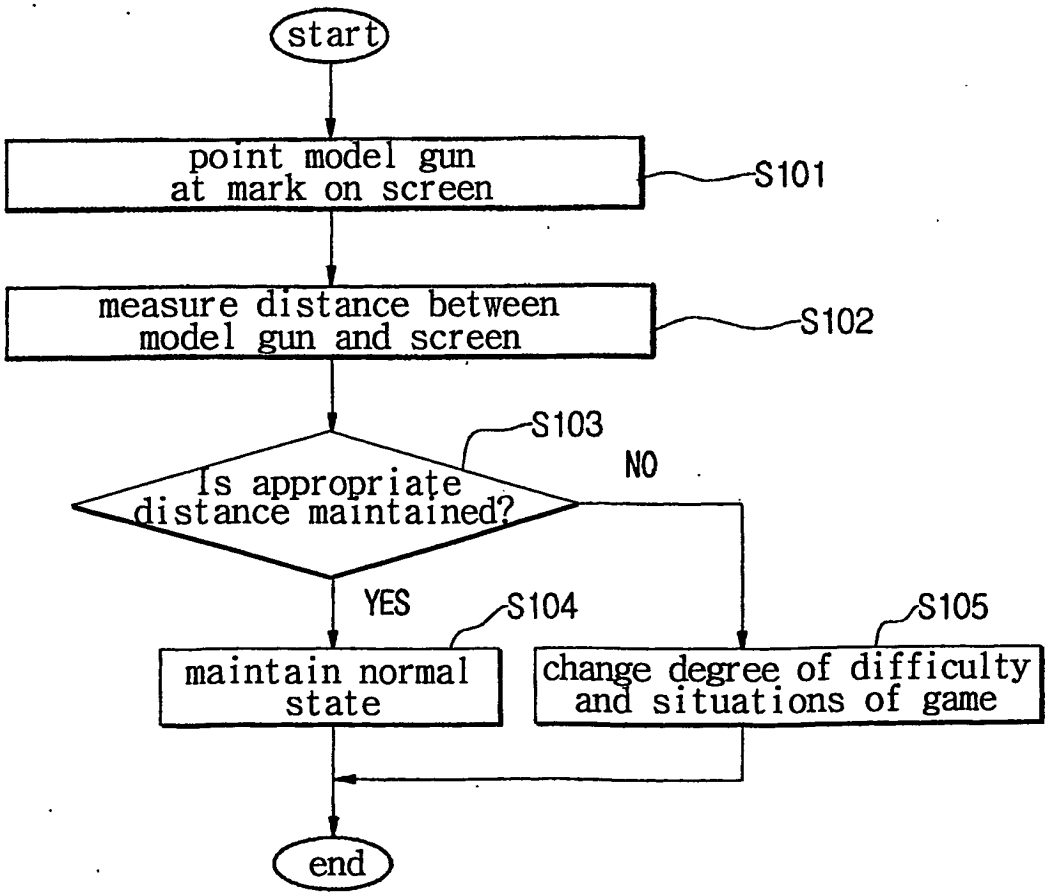

start
point model gun at mark on screen
S101
measure distance between model gun and screen
S102
S103
Is appropriate distance maintained?
NO
YES
S104
S105
maintain normal state
change degree of difficulty and situations of game
end

FIG. 11a

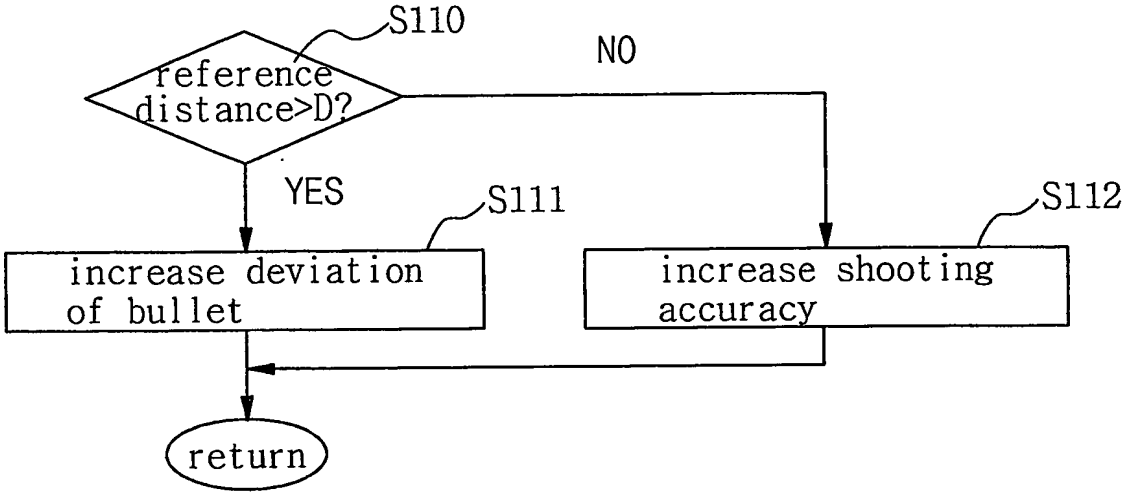


FIG. 11b

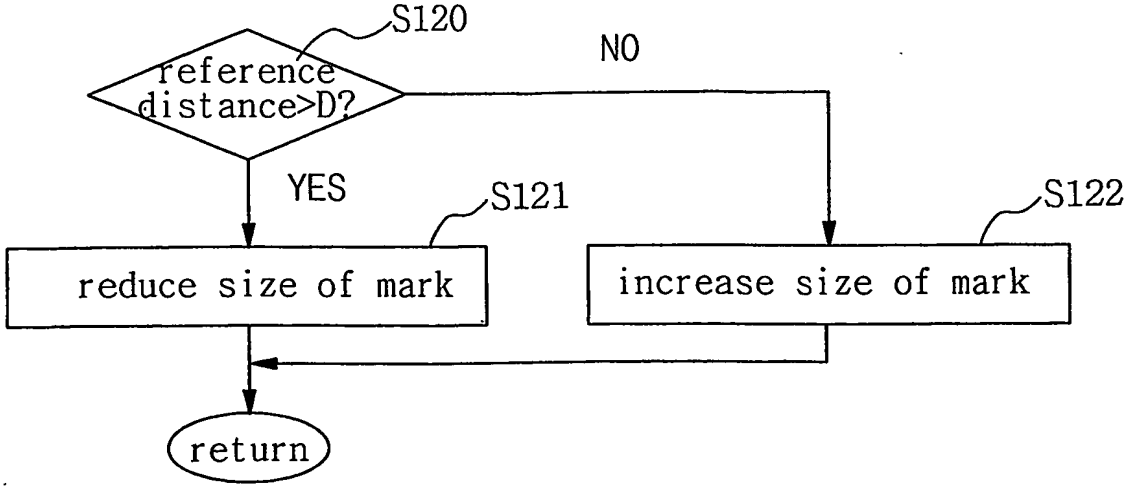


FIG.11c

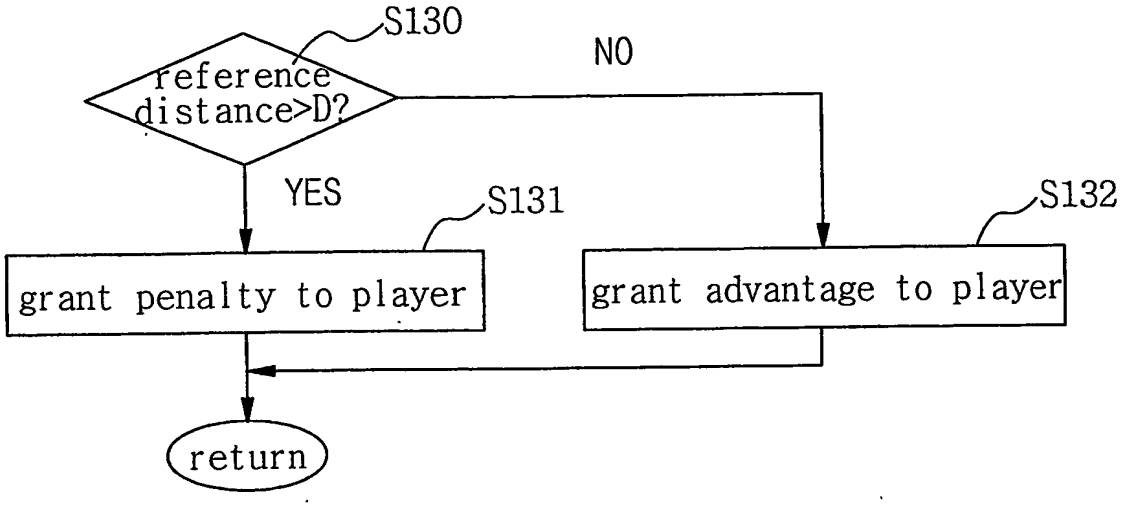


FIG.11d

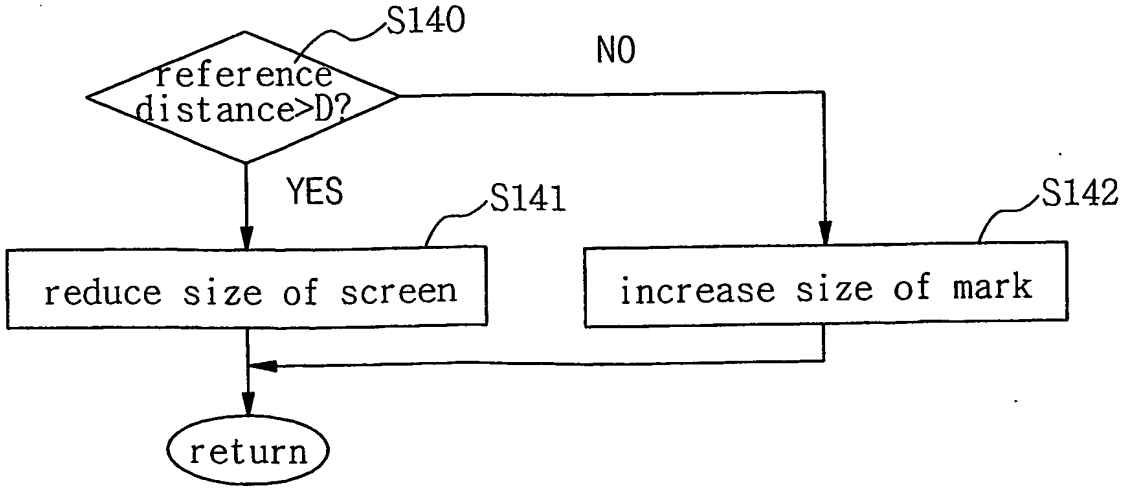


FIG.11e

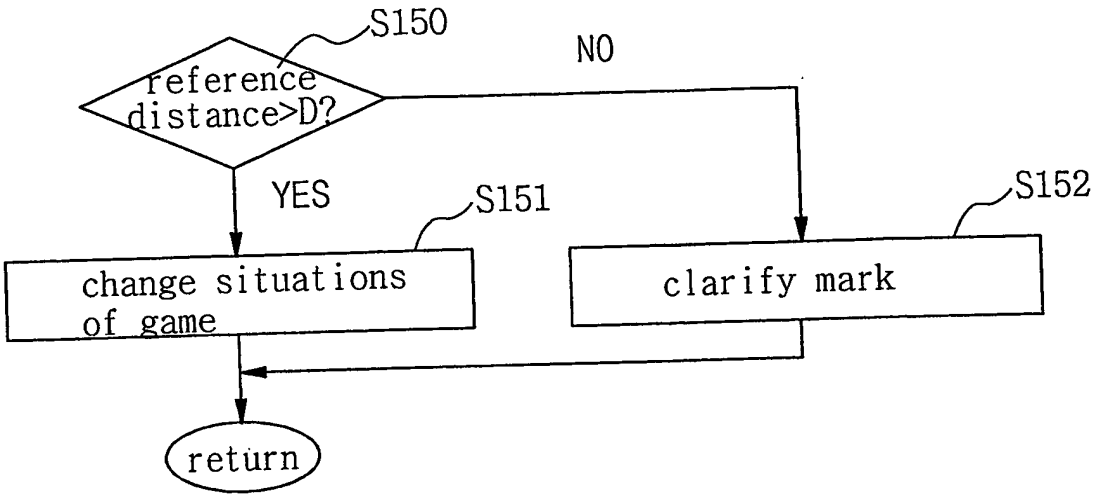


FIG.12a

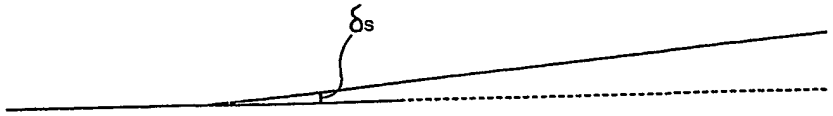


FIG.12b

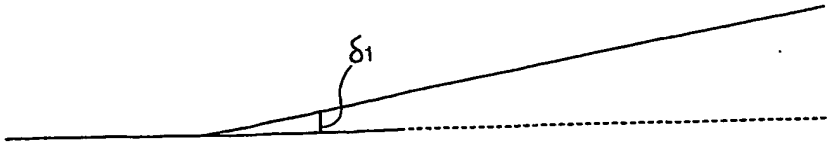


FIG. 13a

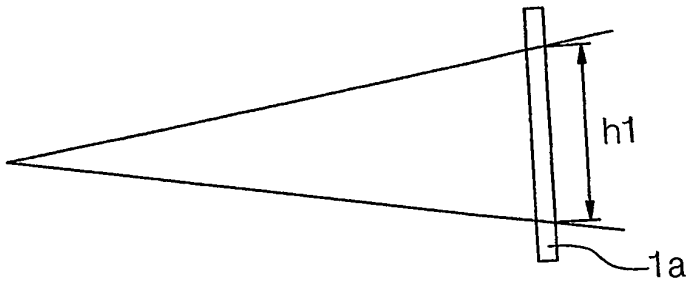
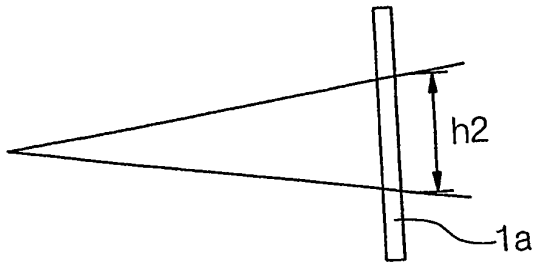


FIG. 13b



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR03/00802

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G06F 19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 G06F 19/00, G06T 15/00, A63F 9/22

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

eKIPASS, shooting, video, game, calculate, computer, gun

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP A1, 0 809 214 (SEGA ENTERPRISES, LTD.) 26 Nov. 1997 See Abstract	1-17
A	EP A1, 0 852 961 (KONAMI CO., LTD.) 15 Jul. 1998 See Abstract	1-17
A	Patent Abstract of Japan, JP08-117447 A (NAMCO LTD) 14 May 1996	1-17
A	Patent Abstract of Japan, JP05-322487 A (NAMCO LTD) 7 Dec. 1993	1-17
A	Patent Abstract of Japan, JP11-319316 A (SEGA ENTERPRISES, LTD.) 24 Nov. 1999	1-17
A	Patent Abstract of Japan, JP2000-102671 A (I-O DATA DEVICE INC.) 11 Apr. 2000	1-17

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 JULY 2003 (29.07.2003)	29 JULY 2003 (29.07.2003)

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